Optical CDMA for CubeSats

Completed Technology Project (2017 - 2018)

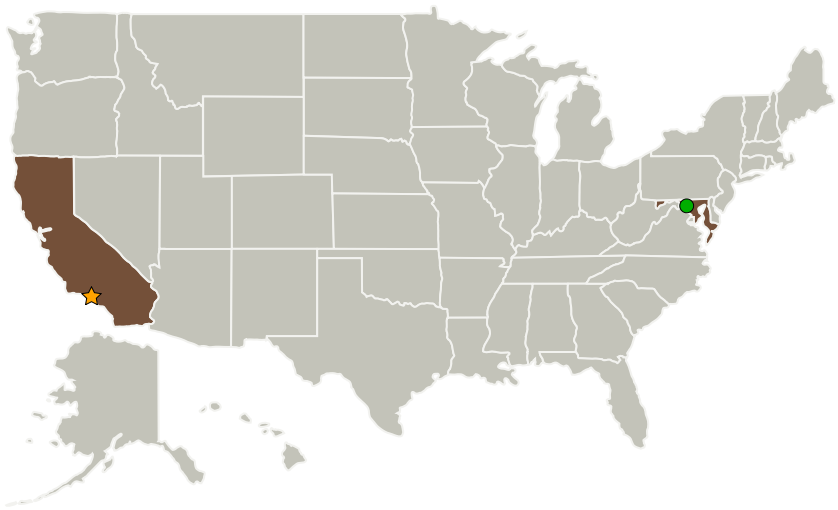
Project Introduction

Design, develop, and analyze an end to end multiple access optical communication system between a constellation of CubeSats and a ground station for simultaneous communication without coordination.

Anticipated Benefits

The designed system has advantages over other types of multiple access systems - Time-Division Multiple Access (TDMA), Wavelength-Division Multiple Access (WDMA), Space-Division Multiple Access (SDMA). All transmit lasers and optical receivers on the CubeSats could have identical implementation except for the signature codes that separate them. Optical CDMA communications between a constellation of CubeSats and an Earth station does not need bandwidth allocations and the number of CubeSats can be increased with graceful degradation in performance.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
●Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Innovation Fund: JPL CIF

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California	Maryland

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: Deep space optical communications, in particular commun ication with a constellation of CubeSats, is one of the strategic technology directi ons of NASA's space exploration. This task designed and analyzed an end-to-end multiple access optical communication system between a constellation of CubeS ats and a ground station for simultaneous communication without coordination u sing M-PPM and Circular Polarization Shift Keying.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Project Management

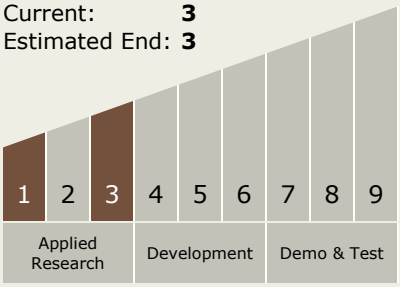
Program Director:
Michael R Lapointe

Program Manager:
Fred Y Hadaegh

Principal Investigator:
Dariush D Divsalar

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.7 Innovative Signal Modulations

Target Destination

Earth